

REMARKS

Claims 1, 2, 3, 6, 10 and 11 have been amended to clarify the language of those claims without narrowing their scope. Claims 1-13 remain under consideration in this application, with no claim previously allowed. Claims 14-19 were withdrawn from further consideration in this application, as being drawn to a non-elected invention.

CLAIM REJECTION – 35 U.S.C. §112

Claims 1-13 stand rejected under 35 U.S.C. §112, first paragraph. Applicants respectfully traverse the Examiner's assertion that the specification as originally filed does not describe the uniformed base region having a uniform doping profile. However, the uniform base region having the claimed uniform doping profile is disclosed in Fig. 4. The related explanation of Fig. 4 is found at page 10, lines 13-26. As explained in the specification as originally filed, the doping profile between the claimed first main electrode region (the first emitter region) 6 and the claimed second main electrode region (the first collector region) 7 is gradually decreased towards the second main electrode region 7 from the first main electrode region 6, as shown in Fig. 4. That is, the donor concentration of the graded base region 5 gradually decreases from $5 \times 10^{16} \text{ cm}^{-3}$ to $1 \times 10^{15} \text{ cm}^{-3}$ along the lateral direction. The minimum impurity concentration of $1 \times 10^{15} \text{ cm}^{-3}$ found at lateral distances of 6-10 μm corresponds to the impurity concentration of the claimed uniform base region 31.

Claims 1 and 6 are here amended to clarify the recitation of the uniform base region. Those claims now state that the uniform base region has a uniform lateral doping profile, the lateral doping profile being measured along a lateral direction parallel to the top surface of the semiconductor substrate. The doping profile shown in Fig. 4 between the first emitter region 6 and the first collector region 7 corresponds to the claimed lateral doping profile being measured along the lateral substrate. The abscissa in Fig. 4, representing the "lateral

distance", is measured along the claimed lateral direction parallel to the top surface of the claimed semiconductor substrate.

Claims 3 and 11 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner asserts that the phrase "rectangular ring shape" is not grammatically correct. Although Applicants disagree with this assertion, Applicants have amended "ring" to --frame--. The claimed rectangular shape is shown in the plan view of Fig. 2B.

CLAIM REJECTION – 35 U.S.C. §103(a)

Claims 1-13 stand rejected as being unpatentable over U.S. Patent No. 4,326,212 to Bergeron et al. ("*Bergeron*") and U.S. Patent No. 4,149,906 to De La Moneda ("*De La Moneda*"). This rejection is respectfully traversed.

Applicants have amended Claims 1 and 6 to recite "a uniform base region of the second conductivity type disposed on said first buried region, the uniform base region having a uniform lateral doping profile, the lateral doping profile being measured along a lateral direction parallel to the top surface of said semiconductor substrate" so as to make the present invention as recited by Claims 1 and 6 more clearly distinguishable from *De La Moneda*. (However, in view of the Examiner's assumption *arguendo* that Applicants are able to show support for the recited uniform doping profile, the present amendments are not considered to narrow the scope of the claims.) The doping profile shown in Fig. 4 between the first emitter region 6 and the first collector region 7 corresponds to the claimed lateral doping profile being measured along the lateral direction parallel to the top surface of the claimed semiconductor substrate. The abscissa in Fig. 4, representing the "lateral distance," is measured along the claimed lateral direction parallel to the top surface of the claimed semiconductor substrate.

In *Bergeron*, there is no disclosure or suggestion of claimed uniform base region having the uniform lateral doping profile, the lateral doping profile being measured

along the lateral direction parallel to the top surface of the claimed semiconductor substrate, as the Examiner admits.

In *De La Moneda*, there is no disclosure or suggestion of the claimed uniform base region having the uniform lateral doping profile. The disclosure shown in the abstract line 11 of *De La Moneda*, which states "a uniform doping profile for the base region of the vertical device," is clearly distinguishable from the claimed uniform lateral doping profile. The claimed lateral doping profile shown in Fig. 4, which is measured along the lateral direction parallel to the top surface of the claimed semiconductor substrate 1, is clearly different from the vertical doping profile shown in Fig. 8B of *De La Moneda*, which is measured along the vertical direction perpendicular to the top surface of the semiconductor substrate 16. Column 8, lines 4-57 of *De La Moneda* teach that the doping profile shown in Fig. 8B is measured along the vertical direction perpendicular to the top surface of the semiconductor substrate 16, from the collector regions 26 and 28 disposed at the top surface to the emitter region 16 at the bottom surface.

The proposed combination of *De La Moneda* and *Bergeron* does not cure the deficiencies in *Bergeron*, since the proposed combination fails to show the claimed graded base region disposed in the claimed uniform base region, enclosing bottom and side of the claimed first main electrode region such that the claimed first main electrode region is disposed in the center at the top surface of the graded base region. Here, the claimed graded base region has the lateral doping profile such that impurity concentration decreases gradually along the lateral direction towards the claimed second main electrode region from the claimed first main electrode region as shown in Fig. 4. Therefore, the proposed combination of *De La Moneda* and *Bergeron* is silent about the geometrical configuration achieved by the combination of the claimed uniform base region and the claimed graded base region. ✓

Application No. 10/014,949
Second Response

Claims 2-5 and 7-13 depend from independent Claims 1 and 6. The remarks made above in support of the independent claims are equally applicable to distinguish the dependent claims from the cited references.

Consequently, in light of the above discussion and in view of the present amendment, the Examiner's rejection against Claims 1-13 under 35 U.S.C. §103(a) as unpatentable over *Bergeron* and *De La Moneda* is respectfully requested to be withdrawn.

The foregoing is submitted as a complete response to the Office Action identified above. This application should now be in condition for allowance, and a notice to that effect is solicited.

Respectfully submitted,



Roger T. Frost
Reg. No. 22,176

KILPATRICK STOCKTON LLP
Suite 2800
1100 Peachtree Street
Atlanta, Georgia 30309
(404) 815-6500
Docket: 44471-265522

VERSION WITH MARKINGS TO SHOW CHANGES

IN THE CLAIMS

The following claims are amended:

1. (Twice Amended) A lateral transistor comprising:
 - a semiconductor substrate of the first conductivity type;
 - a buried region of the second conductivity type disposed on said semiconductor substrate;
 - a uniform base region of the second conductivity type disposed on said first buried region, the uniform base region [and] having a uniform lateral doping profile, the lateral doping profile being measured along a lateral direction parallel to the top surface of said semiconductor substrate;
 - a plug region of the second conductivity type disposed in said uniform base region, the plug region protrudes from a top surface of said uniform base region so as to reach to said buried region;
 - first and second main electrode regions of the first conductivity type disposed in and at the top surface of said uniform base region, the first and second main electrode regions being aligned in [a] the lateral direction [parallel to the top surface of said uniform base region]; and
 - a graded base region of the second conductivity type disposed in said uniform base region, enclosing bottom and side of said first main electrode region such that said first main electrode region is disposed in the center at the top surface of the graded base region, the graded base region having a doping profile such that impurity concentration decreases gradually along the lateral direction towards said second main electrode region from said first main electrode region,

wherein a combination of said uniform base region and said graded base region serves as a base region.

2. (Twice Amended) The lateral transistor of claim 1, wherein said second main electrode region is formed in a [ring] frame shape along the top surface of said uniform base region, configured such that said second main electrode region laterally surrounds said graded base region.

3. (Once Amended) The lateral transistor of claim 2, wherein said second main electrode region is formed in a rectangular [ring] frame shape.

6. (Twice Amended) A semiconductor integrated circuit including a lateral transistor, the lateral transistor comprising:

a semiconductor substrate of the first conductivity type;

a first buried region of the second conductivity type disposed on said semiconductor substrate;

a uniform base region of the second conductivity type disposed on said first buried region, the uniform base region having a uniform lateral doping profile, the lateral doping profile being measured along a lateral direction parallel to the top surface of said semiconductor substrate;

a first plug region of the second conductivity type disposed in said uniform base region, the first plug region protrudes from a top surface of said uniform base region so as to reach to said first buried region;

first and second main electrode regions of the first conductivity type disposed in and at the top surface of said uniform base region, the first and second main electrode regions being aligned in [a] the lateral direction [parallel to the top surface of said uniform base region]; and

a graded base region of the second conductivity type disposed in said uniform base region, enclosing bottom and side of said first main electrode region such that said first main electrode region is disposed in the center at the top surface of the graded base region, the graded base region has a doping profile such that impurity concentration decreases gradually along the lateral direction towards said second main electrode region from said first main electrode region,

wherein a combination of said uniform base region and said graded base region serves as a first base region of said lateral transistor.

10. (Twice Amended) The lateral transistor of claim 7, wherein said second main electrode region is formed in a [ring] frame shape along the top surface of said uniform base region, configured such that said second main electrode region laterally surrounds said graded base region.

11. (Once Amended) The lateral transistor of claim 10, wherein said second main electrode region is formed in a rectangular [ring] frame shape.

Claims 14-19 are cancelled.